

29 NOV 2001

## ARRANGEMENT FOR TREATING SOLIDS SETTLED ON THE BOTTOM OF AN ELECTROLYTIC TANK

The present invention relates to an arrangement for treating solids settled on  
5 the bottom of an electrolytic tank.

In electrolytic processes, metals such as copper, nickel and zinc, are precipitated on the surfaces of cathodes located in the electrolytic tank, starting either with metal anodes that are dissolved into the electrolyte present in the  
10 electrolytic tank, or with metal ions that are already dissolved into the electrolyte. However, all solids are not precipitated onto the cathode surfaces, for example precious metals and solid impurities present in the electrolyte. Therefore on the bottom of electrolytic tanks, there are accumulated, along with the metal refining process, various solids that must from time to time be  
15 removed from the tank, for instance because said solids contain valuable ingredients, such as precious metals, or because a thicker solids accretion threatens the purity of the cathode obtained from the electrolytic process.

Usually the solids accumulated in the electrolytic tank are at least partly very  
20 finely divided and only somewhat heavier than the electrolyte, wherefore it is difficult to separate the solids from the electrolyte. During the electrolytic process, the circulation of the solids from off the bottom of the electrolytic tank is very harmful, because in that case there is a particularly high risk that the solids proceed onto the cathode, and this would essentially weaken the purity  
25 of the metal to be produced.

The removal of the solids accumulated on the bottom of an electrolytic tank usually requires that the whole electrolytic process must be interrupted, which reduces the efficiency per time, i.e. the productivity of the electrolytic plant.  
30 Hence the removal of solids must be arranged so that it forms part of the process of replacing the electrodes, i.e. anodes and cathodes; this, however makes the replacement process complicated and slow, and also restricts the

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removal of solids to take place in the rhythm dictated by the process of replacement. Moreover, a remarkable amount of the electrolyte must be first removed from the tank and then fed back therein, which generally leads to harmful effects in the electrolyte quality and causes a lot of extra work. Into the solids treatment system, there also flows a remarkable amount of electrolyte, which must be replaced with new and may be harmful in the further treatment of the solids. Moreover, the manual washing of the electrolytic tanks makes the process clearly more labor-intensive and subjects the employees to various health hazards, among others owing to the effects of the ingredients contained in the splashes and spray emanating from the tank. In addition, owing to the personnel required by the washing of the tanks, the automatization of the electrode treatment is often nearly impossible, which further increases the labor demand in an electrolytic plant.

From the international patent application WO 99/11841, there is known a separating element for separating the bottom part of an electrolytic tank from the rest of the tank space in connection with the removal of the solids settled on the tank bottom. In said publication, in the electrolytic tank there are arranged support and control members that form the trajectory of the separating element, so that the separating element can be placed in the electrolytic tank and removed therefrom through a space provided in between at least one end wall and the electrode placed nearest to said end wall. In the arrangement according to said publication, the separating element is provided with nozzles attached thereto, and through said nozzles, liquid or gas is conducted to the bottom part of the electrolytic tank in order to help remove the solids. The solids and liquid are removed for instance through a discharge aperture provided in the electrolytic tank bottom. However, the solids may contain particles that are coarser than the rest of the material and are not discharged in the manner described above. Owing to their larger size, they also may cause blockages in the outlet channels. Typically the particles with a larger grain size are separated from the finer slurry after the tank cleaning step.

The object of the invention is to realize a completely new type of arrangement to be used for treating the solids settled on the bottom of an electrolytic tank. The invention is characterized by the novel features set forth in the appended  
5 claims.

The arrangement according to the invention is characterized in that it comprises a collector element which is moved essentially along the electrolytic tank bottom or in the vicinity thereof, said collector element  
10 comprising means for separating coarse particles from the rest of the solids. By means of the arrangement according to the invention, coarse particles can be separated from the rest of the solids already in the electrolytic tank, preferably without having to first drain the electrolyte from the tank. The arrangement can also be used in connection with the cleaning of an already emptied tank.

15 A preferred embodiment of the arrangement according to the invention is characterized in that the means for separating coarse particles consist of a sieve element. By installing the sieve element in the collector element, there is obtained an advantageous and effective structure for separating and collecting  
20 coarse particles.

Another preferred embodiment of the invention is characterized in that in connection with the collector element, there is arranged a lid element, so that the collector element and/or the lid element are movable at least with respect  
25 to each other. By providing the collector element with a movable lid arrangement, it can be ensured that the separated coarse particles cannot move from the collector element back to the tank, when the collector element is being removed from the tank.

30 Another preferred embodiment of the invention is characterized in that the arrangement comprises means for directing a jet of some intermediate agent to the solids in the collecting direction prior to the collector element. By means of

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intermediate agent jets, the detaching of the solids from off the tank bottom can be boosted, and their transfer to the collector element as well as the separation of solids by the sieve element and the passage of the finer particles through the sieve can be intensified.

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By providing the arrangement according to the invention preferably with at least one suction element arranged in succession to the collector element in the collecting direction, at least an essential part of the finer solids particles that penetrated the sieve element of the collector element are effectively

10 removed from the tank.

The invention is explained in more detail with reference to the appended drawings, where

figure 1 shows a preferred embodiment of the invention in an electrolytic tank, 15 seen in a side-view illustration in partial cross-section,

figure 2 illustrates the embodiment of figure 1, seen in the direction A - A,

figure 3 illustrates an embodiment of the arrangement according to the invention, seen in a partial side-view cross-section,

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figure 4 illustrates an embodiment according to the invention, seen in the direction B - B of figure 3, and

figure 5 illustrates another embodiment according to the invention, seen in the direction B - B of figure. 3.

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Figures 1 and 2 represent a general illustration of an electrolytic tank 1, where there are in turns placed electrodes, anodes 2 and cathodes 3, and the metal to be produced in the electrolytic process is precipitated onto the cathode by means of an electrolytic solution 4 present in the electrolytic tank. During the electrolytic process, on the bottom 5 of the electrolytic tank 1 there are settled solids 6 that should be removed from the electrolytic tank from time to time.

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The arrangement for treating the solids settled on the electrolytic tank bottom comprises a collector element 11, which is movable essentially along the

bottom 5 of the electrolytic tank 1 or in the vicinity thereof, said collector element 11 comprising means for separating coarse particles from the rest of the solids. Said collector element 11 is typically formed to be for instance ladle-like in shape, so that in the collecting position, the front edge 11a of the  
5 collector element is arranged against the tank bottom 5, in which case, when moving the collector element, the solids 6 settled on the tank bottom are transferred to the collector element, onto the means provided therein for separating coarse particles from the rest of the solids. In a typical example, the size of the coarse particles is of the order 2 - 60 mm.

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The means provided in the collector element for separating coarse particles typically consist of a sieve element 12. As for the sieve element, it is typically formed on the inner surface of the collector element, in which case the coarser particles are left in the collector element, whereas the finer particles pass  
15 through the sieve elements arranged in the collector element. According to a preferred embodiment (figure 4), the collector element is at least partly made of a plate provided with apertures 13, and the size of said apertures 13 is matched according to the desired separating capacity. The size and shape of the apertures 13 provided in the sieve element depend on the properties of the  
20 solids under treatment.

According to another preferred embodiment (figure 5), the sieve element of the collector element 11 is composed of bar elements 14 that are spaced apart. The mutual distance between the adjacent bar elements is matched according  
25 to the desired separating capacity. Thus at least one wall of the collector element 11 is made rake-like, so that the bar elements 14 represent the peaks in said rake element. In the case according to the drawing, the bar elements 14 are bent double, at least at the end that is in contact with the tank bottom 5, preferably essentially in an U-shape.

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In a preferred embodiment according to the invention, in connection with the collector element 11, there is arranged a lid element 15, so that the collector

element 11 and/or the lid element 15 are movable at least with respect to each other. According to a preferred embodiment, the collector element 11 is arranged turnably in a drive apparatus 10. The collector element is arranged to turn from the collecting position to the top position 11' (illustrated by dotted lines in figure 3), in which top position the lid element 15 prevents the coarse particles that are left in the collector element 11 from flowing out of the collector element for instance when the collector element is being removed from the tank 1. In the embodiment of figure 3, the lid element 15 is arranged in the separating wall 10, serving as the drive apparatus, movably at the edge thereof. Between the lid element 15 and the collector element 11, there is arranged transmission, for example wire transmission. The lid element 15 is installed in the separating wall 10, at the front edge and movably in the motional direction thereof, so that when the lid element 15 touches the (end) wall of the tank, the lid element 15 is stopped, while the fastening point of the collector element 11 still proceeds somewhat towards the wall. Now the wire transmission turns the collector element from the collecting position to the top position 11', where the collector element is advantageously locked. Thereafter the collector element 11 can be removed from the tank 1, for example by moving it by the drive apparatus 10 to the direction opposite to the collecting direction.

The collector element 11 is attached, by intermediation of a fastening element 16, to the drive apparatus 10. In the fastening element, there is provided a transversal axis element 17, around which the collector element is turnably arranged. The lid element 15 is installed, by intermediation of at least one support member 18, so that it is movable back and forth in the collecting direction. In the embodiment according to figure 3, the motion of the lid element 15 is transmitted by transmission means 19, 20, particularly wire transmission means, to a rotary motion of the collector element 11 around the axis 17. Around the axis 17, there is provided a sleeve element 19 to which the collector element 11 is attached. Around the sleeve element 19, there is wound a cable wire 20, which is fastened, at least in one point, to the sleeve element

10 The collecting and separating effects of the arrangement according to the invention can be intensified, when the arrangement comprises means 23, 24 for directing a jet 25 of some intermediate agent to the solids 6 in the collecting direction, prior to the collector element 11. The intermediate agent jets push the solids 6, particularly the finer solids, towards the collector element 11, and  
15 further through the sieve element 12, 14.

The arrangement may comprise suction elements 26 that are advantageously positioned in the collecting direction after the collector element, in order to remove from the tank at least part of the finer solid particles that have passed the sieve of the collector element 11. Thus the bottom 5 of the electrolytic tank is cleared of solids 6, and simultaneously the solids are classified according to particle size. The separating capacity can be boosted further, when the means for directing an intermediate agent jet to the solids comprise at least one nozzle 23, which is directed towards the sieve element 12, 14 of the collector element. The nozzles 23, 24 can be arranged for example in the lid element 15, which in the collecting position extends to a distance from the collector element 11 in the collecting direction.

In the embodiment according to figures 1 and 2, the arrangement according to 30 the invention is attached to the separating wall 10, which at the same time serves as the drive apparatus of the collector element. In connection with the electrolytic tank, preferably in the side walls 7, 8 of the tank, there are provided

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support and control members 9. By means of the support and control members 9, the separating element serving as the drive apparatus is supported, while the separating element is placed in the electrolytic tank 1, and controlled while it is being immersed in the electrolytic tank, in which case the created trajectory 5 is mainly defined by the support and control members. Typically the employed support and control members 9 are grooves provided in the opposite walls 7, 8 of the tank, wherein the side edges of the separating element 10 are matched to fit. One embodiment of said separating wall is described in the publication WO 99/11841.

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The arrangement according to the invention is operated for instance as follows. The arrangement is transferred onto the bottom of an electrolytic tank, for example at one end of the tank, between the tank wall and the electrode that is located nearest to said wall. The collector element is moved along the bottom, 15 so that the solids settled on the bottom are treated with the collector element. The finer solid particles pass the sieve provided in the collector element, whereas the coarser particles remain in the collector element. The finer particles that passed the sieve of the collector element 11 are conducted, along a conduit 27, out of the tank; they are collected in said conduit 27 by 20 means of at least one suction element 26 that is located in succession to the collector element 11 in the collecting direction. The collecting and/or separating effect can be further intensified by directing jets 25 of some intermediate agent to the material 6 under treatment, in the collecting direction prior to the collector element and/or to the sieve of the collector element 11. When the 25 collector element 11 has reached the opposite end of the tank, the collector element rises to the top position 11', where the front edge 11a of the collector element is placed essentially against the lid element 15. The coarser particles collected in the collector element 11 remain in the collector element 11 while it is moved to the opposite direction, out of the tank. Typically the collector 30 element is first stopped at a short distance from the final position, and underneath it there is placed a vessel for receiving the coarser particles. Then the collector element is transferred to the unloading position, where it is



5 For a man skilled in the art, it is obvious that the invention is not restricted to the above described embodiments only, but it can be modified within the scope of the appended claims.

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